(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
2 August 2001 (02.08.2001)

PCT

(10) International Publication Number
WO 01/56297 A1

(51) International Patent Classification[7]: H04N 7/24, 5/00

(21) International Application Number: PCT/US01/02628

(22) International Filing Date: 26 January 2001 (26.01.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
09/492,887 27 January 2000 (27.01.2000) US

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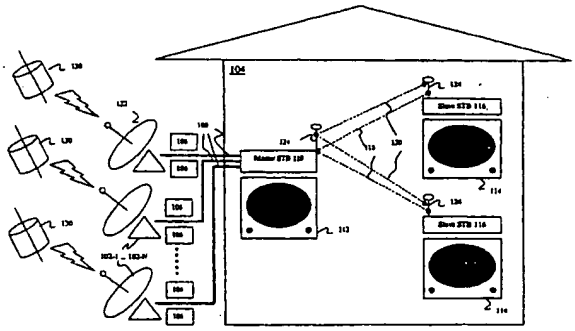
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: HOME VIDEO DISTRIBUTION AND STORING SYSTEM



(57) Abstract: A home video distribution and storage system provides for wireless distribution of signals from direct-to-home satellite services and Internet services. Antenna dishes outside the home are connected to a master set-top box (MSTB), which is connected to the main TV in the home. Inside the MSTB, the coax cables from the TV receivers are terminated in an RF switch box which can be either manually or electronically controlled. The output of the RF switch box is connected to one or more 6-MHz TV tuners, which are used to down convert the wide band signal containing up to 175 channels into the desired 6 MHz baseband signal. The desired baseband signal is then demodulated and demultiplexed into one or more MPEG2 audio/video signal program streams. The program streams are combined in a multiplexer that then aggregates all the selected program streams for accessibility by the various TV sets in the home. TV and Internet signals are fed both to the local TV set and to a base station radio transceiver. The transceiver sends the desired information to the other TV sets via local antennas and slave set top boxes (SSTBs). Each SSTB contains a mobile radio transceiver and thus becomes a wireless terminal to the wireless base station transceiver in the MSTB. This terminal can be used for either traditional or interactive TV viewing and/or Internet access. The MSTB can further include a video memory system (VMS) to provide centralized storage of video and/or Internet streams for access and use by TVs throughout the home.

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HOME VIDEO DISTRIBUTION AND STORING SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to video distribution and, more particularly, to a system for storing and wirelessly transporting video signals throughout the home.

2. Description of the Related Art

Home satellite feeds have become more common in recent years with the introduction of direct-to-home satellite signals that are compatible with small fixed parabolic or "dish" antennas, popularized by services such as DirecTV and Echostar.

Difficulties arise, however, when attempting to feed satellite signals to more than one TV in the home. Prior methods require that the user install cables to any TV sets that are remote from the master set. Usually this would mean that the user would contract with an installer for such a service. If the setup is changed in any way after installation, the installer might have to be called back since in general users are not skilled in making TV connections.

Although satellite TV operators provide manuals that describe how their systems are to be hooked up for multiple users, even with instructions such tasks are generally beyond the capabilities of many consumers.

Moreover, if satellite Internet or other Internet signals are desired to be fed to TVs in the home (e.g. by satellite or cable modems), or if interactive TV services are desired, the prior methods require a separate set of cables for providing interactive TV or Internet access signals to the different TV sets.

In addition to video distribution within the home, storage of video signals also presents difficulties. Prior methods require that the user install storage devices including recording functions for each TV set. In this regard, TiVO and Replay Networks offer variants of video storage devices implemented by the use of hard disk drives. These systems typically utilize video encoding devices (e.g. Sony, Stream Machine, iCompression, I-Cube) for converting NTSC video into MPEG2 streams. However, these individual video storage devices do not support access to multiple TV sets or wireless

access.

Therefore, there remains a need in the art for a system for storing and transporting video signals throughout a home that overcomes the aforementioned difficulties. The present invention fulfills this need, among others.

SUMMARY OF THE INVENTION

An object of the present invention is to overcome the prior art problems in providing transport and storage of both TV and Internet signals throughout the home.

Another object of the invention is to provide a means for transporting and storing both TV and Internet signals throughout the home that is easy to install.

Another object of the invention is to provide a means for transporting and storing both TV and Internet signals throughout the home that does not require extensive additional cabling.

Another object is to provide a means for transporting and storing both TV and Internet signals throughout the home that does not require separate cabling for TV and Internet signals.

Yet another object of the invention is to provide a means for storing both TV and Internet signals that is accessible and usable by all TV sets in a home.

To achieve these objects and others, the invention provides for wireless distribution of signals from direct-to-home satellite services and Internet services. According to a preferred embodiment of the present invention, antenna dishes outside the home are connected to a master set-top box (MSTB), which is connected to the main TV in the home. Inside the MSTB, the coax cables from the antenna dishes are terminated in a switch box which can be either manually or electronically controlled. The output of the switch box is connected to one or more 6-MHz TV tuners, which are used to down convert the wide band signal containing up to 175 channels into the desired 6 MHz baseband signal(s). Each desired baseband signal is then demodulated and demultiplexed into one or more MPEG2 audio/video signal program streams or Internet IP streams. The MSTB may also receive signals from a conventional Internet access means such as a telco line, xDSL, or cable modem.

The program and Internet streams are combined in a multiplexer that then aggregates all the selected streams for accessibility by the various TV sets in the home. TV and Internet signals are fed

both to the local TV set and to a base station radio transceiver. The transceiver sends the desired information to the other TV sets via local antennas and slave set top boxes (SSTBs). Each SSTB contains a mobile radio transceiver and thus becomes a wireless terminal to the wireless base station transceiver in the MSTB. This terminal can be used for either traditional or interactive TV viewing and/or Internet access. The MSTB can further include a video memory system (VMS) to provide centralized storage of video and/or Internet streams for shared access and use by TVs throughout the home.

In another preferred embodiment of the present invention, the functions of the master set-top box (MSTB) are included in a house side box (HSB) located outside the home, thereby reducing the need for hardware in the home. Additionally, by introducing only limited hardware inside the home, the distances of the wireless links may be advantageously reduced.

The present invention provides a flexible approach to the distribution of TV and Internet signals throughout the home. User convenience is enhanced by a seamless management of reception, transmission, storage and control.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects and advantages of the present invention will become apparent to those skilled in the art after considering the following detailed specification, together with the accompanying drawings wherein:

FIG. 1 illustrates a system for distributing satellite TV and Internet signals throughout a home in accordance with the principles of the invention;

FIG. 2 illustrates a master set top box that can be used in the system shown in FIG. 1 in accordance with the invention;

FIG. 3 illustrates a slave set top box that can be used in the system shown in FIG. 1 in accordance with the invention;

FIG. 4 illustrates an alternative embodiment of a master set top box that can be used in the system shown in FIG. 1 so as to further provide storage of satellite TV and Internet signals in accordance with the invention;

FIG. 5 illustrates an alternative embodiment of a master set top box that can be used in the system shown in FIG. 1 so as to further provide storage of satellite TV and Internet signals (both wireless and wire-line) in accordance with the invention;

FIG. 6 illustrates an alternative embodiment of a system for distributing satellite TV and Internet signals throughout a home in accordance with the principles of the invention;

FIG. 7 illustrates a house side box that can be used in the system shown in FIG. 6 in accordance with the invention;

FIG. 8 illustrates a slave set top box that can be used in the system shown in FIG. 6 in accordance with the invention; and

FIGS. 9A and 9B respectively illustrate alternative embodiments of the invention wherein cabling is completely or partially eliminated from the home.

DETAILED DESCRIPTION OF THE INVENTION

FIG. 1 illustrates an exemplary implementation of the invention.

As illustrated, N small Direct to Home television receiver dish antennas 102-1 to 102-N are located outside the home 104. It should be noted that in some cases, such as with the Hughes DirecTV system, there are three satellites always at 101 degrees west longitude so only one dish 102 is needed. In other cases, such as with the Echostar system, more than one fixed dish may be needed to gather signals from multiple satellites 130. It should be further apparent that the present invention is not limited to use in a home, but can be applied to other environments where the video distribution and storing objects of the invention are desired, such as, for example, apartment buildings, bars and restaurants, and offices. Moreover, although it is believed that the advantages of the invention are particularly evident with satellite TV signals, other similar wideband digital TV signals can be distributed according to the invention.

Also shown is Internet satellite receiver dish 122 for providing two-way Internet satellite services; such services may or may not also include TV broadcast links. It should be noted that while Internet satellite services are illustrated in FIG. 1, other conventional means for providing two-way Internet services are also possible in accordance with the invention, such as by telephone company

(Telco) POTS, Telco xDSL, cable modems, etc.

The antenna dishes each contain one or two Low Noise Blocks (LNB) 106 which are pre-amps for the wideband satellite signal. Two LNBs are used for one dish in case both horizontal and vertically polarized RF signals are desired. The LNBs are connected to (optional) in-line wideband amplifiers (e.g. RCA C803, not shown), which are in turn connected to the master set-top box (MSTB) 110 by coaxial cables 108, one per LNB. These cables are preferably of the large variety, e.g. RG-6. As should be apparent, N+1 to 2(N+1) cables 108 are needed.

The MSTB 110 is connected to the main TV 112 in the home. As will be described in more detail below, inside the MSTB 110, the coax cables from the TV receivers 102 are terminated in a switch box that can be either manually or electronically controlled. The output of the switch box is connected to one or more 6-MHz TV tuners, which are used to down-convert the wide band signal containing up to 175 channels into the desired 6 MHz baseband signal. The desired baseband signal is then demodulated and demultiplexed into one or more MPEG2 audio/video signal program streams or IP streams. The program or IP streams are combined in a multiplexer that then aggregates all the selected program or IP streams for accessibility by the various TV sets in the home 104. The multiplexer feeds TV and Internet signals to both the local TV set 112 and to a base station radio transceiver. The transceiver sends the desired information to the other TV sets 114 via local antennas 124 and slave set top boxes (SSTBs) 116. Antennas 124 are preferably fixed directional antennas with LEDs to provide radio signal strength indication, such as the indicators found on cellular phones.

The wireless interface between MSTB 110 and SSTBs 116 can be either point to point or point to multipoint. In the case of point to point, each SSTB 116 has its own dedicated signal, in both directions. The return signal is to accommodate both interactive TV and Internet information. In the case of point to multipoint, the system takes advantage of the situation wherein several TVs are tuned to the same channel, thereby conserving bandwidth for other uses such as high-definition TV or Internet traffic.

One of the program streams can be fed to main TV 112, which is near the MSTB 110. MPEG2 and AC3 decoders are located either in the MSTB 110 or the TV 112, or both. The TV will

typically be able to exhibit more than one simultaneous picture (e.g. Picture in Picture, array of pictures).

Additional TVs 114 in the home are connected wirelessly via SSTBs 116. Each SSTB 116 contains a mobile radio transceiver and thus becomes a wireless terminal to the wireless base station transceiver in the MSTB 110. This terminal can be used for either traditional or interactive TV viewing and/or Internet access.

There are two signal types between the MSTB 110 and the SSTBs 116. A downlink signal 118 contains the video transport streams requested by the SSTB 116 and an Internet downlink. An uplink signal 120 contains the control signals (for controlling the MSTB tuner, etc.) and an Internet access uplink. The aggregate data rate for the system is 100 Mb/s, which by means of the wireless protocol software, may be divided any number of useful ways. Five remote SSTBs 116 would require an aggregate bandwidth of about 100 Mb/s (assuming the downlinks are distributed between 3 Mbps and 30 Mbps), which is within the capability of the 100 Mbps aggregate bandwidth.

FIG. 2 further illustrates a master set top box which can be an implementation of MSTB 110 in accordance with the principles of the invention.

As shown, MSTB 110 includes RF switch 202, tuners 204, demux chains 206-1 to 206-M, mux 208, Internet access modem 210, wireless protocol converter 212, and base station radio transceiver 214. Local set interface 216 can also be included in MSTB 110 as shown in this example. Alternatively, some or all of the functionality of local set interface 216 can be incorporated within TV set 112, which may be either a combination of set top box converter plus TV display or an integrated TV receiver. (Examples of both may be found in products by Panasonic, Sony, Thomson/RCA, or Mitsubishi.) It will be obvious to one skilled in the art that the functional blocks indicated in 216 may actually be implemented by software executed in a main processor chip for the STB that controls all operations, such as a Pentium or a MIPS, or in various other combinations of one or more integrated chips and/or chipsets.

The coax cables 108 from the satellite TV receivers 102-1 to 102-N input the wideband TV signals into MSTB 110 and are terminated in RF switch 202. RF switch 202 can be either manually

or electronically controlled to select a receiver 102 from which to obtain TV signals. Preferably, as shown in FIG. 2, RF switch 202 is electronically controlled by control signals originating from the SSTBs 116 and local set interface 216.

The selected output of the RF switch 202 is provided to one or more 6-MHz TV tuners 204, which are used to down-convert the wide band signal containing up to 175 channels into the desired 6 MHz baseband signal (i.e., the baseband signal of the desired one of the 175 channels). By providing the output of the RF switch 202 to multiple 6 MHz TV tuners 204, multiple channel viewing (including picture-in-picture) is enabled for wide-band channel inputs. The TV tuners 204 can be implemented by, for example, conventional can-type tuners from Alps or a variety of vendors, or electronic tuners from Microtune. The desired signal is indicated and controlled by the tuner control signals originating from the SSTBs 116 and local set interface 216.

The 6MHz baseband signal from one of tuners 204 is then provided to an associated one of demux chains 206-1 to 206-M. After demodulation, typically based upon QPSK, and removing the Forward Error Correction (e.g., as required by DirecTV or Echostar), the resulting signal consists of MPEG2 Transport streams that in turn can contain one or more MPEG2 audio/video packetized elementary streams (i.e., one for each program) as described in the MPEG-2 standard ISO/IEC 11171-1: Systems (Nov 1991). On DirecTV the transport streams are 23 and 30 Mbps, depending on the satellite. Preferably, for transport streams carrying more than one program, multiple demux chains 206 are provided for each tuner. The demux chains 206 can be implemented by, for example, chip sets provided by ST, LSI Logic, Philips/VLSI, and others.

Conditional access (CA) means is provided for each demux chain 206 by means of one or more removable smart card or Point of Deployment (POD) module such as those built for service providers by GI, Scientific-Atlanta, NDS, Nagra Interlocka, and GemPlus and accessed through port 232 by means familiar to those of skill in the art. These CA means can be provided to access subscription services such as HBO, satellite TV services, or Internet services, and to prevent access by unauthorized users or pirates. The MSTB may provide all CA support for the home; alternatively, CA devices can be provided in each SSTB.

The decoded streams are combined in multiplexer 208 that aggregates all the selected program streams and Internet streams for access by the various TV sets in the home 104. Multiplexer 208 can be implemented by, for example, creating a new MPEG-2 transport stream which is a merged version of the MPEG-2 streams which feed such multiplexer. The multiplexer 208 feeds TV and Internet signals to both the local TV set 112 and to base station radio transceiver 214. The multiplexer 208 may optionally include conditional access (CA) encryption means if for example the MSTB 110 is implementing a CA procedure that requires CA decryption by the SSTBs 116 (e.g., for adult content or a subscription service).

The transceiver 214 sends the desired information to the other TV sets 114 via local antennas 124 and slave set top boxes (SSTBs) 116. Base station transceiver 214 is preferably any product developed according to the HiperLAN and HiperLAN/2 standards for high performance radio local area networks, which standards are described in, for example, G. A. Halls, "HIPERLAN: the high performance radio local area network standard," Electronics & Communication Engineering Journal, Dec. 1994, pp. 289-296 and M. Johnsson, "HiperLAN/2 -- The Broadband Radio Transmission Technology Operating in the 5 GHz Frequency Band," (1999). Internet access modem 210 can be implemented by, for example, a two-way satellite modem such as the Satellite Express 2530XL USB (Universal Serial Bus) Satellite Receiver provided by BroadLogic. It should be apparent, however, that for other Internet communication means such as Telco POTS, Telco xDSL or cable modems, that correspondingly different modems 210 would be provided. The satellite Internet service example is provided for illustration, and those skilled in the art will be able to practice the invention using such other Internet communication means after being taught by this illustration.

Signals are directed to the different receiving entities per control signals to the multiplexer 208. This can be done in two ways depending upon whether point to point or point to multipoint RF transmission is used.

In the case of point to multipoint, each SSTB receiving entity sends program selection signals to the base station indicating the channel(s) desired for viewing. The collection of these various selection signals indicates to the MSTB which channels are to be outputted by the RF Switch

110 and decoded, and subsequently re-multiplexed into a new MPEGII stream for broadcast to the collection of SSTBs. Upon receipt of this new MPEGII stream, each SSTB decodes the stream based upon its original requirements and selects the programs it requires.

In the case of point to point, each SSTB again sends program selection signals to the base station indicating the channel(s) desired for viewing. Each SSTB has a dedicated two-way link so separate MPEGII streams are sent to each SSTB.

The wireless protocol used for both the point to multipoint and the point to point methods described above can be developed specifically for this application. For example, a Media Access Control protocol can be used to take advantage of the particular RF modulation scheme that is used.Wireless protocol converter 212 can be implemented according to, for example, 802.11, or any number of advanced wireless multiple access controller protocols such as HiperLAN/2. This block formats downlink signals containing program streams and Internet streams from mux 208 into the appropriate protocol for wireless transmission between base station transceiver 214 and the slave STBs 116. It also converts uplink signals from slave STBs 116 received by transceiver 214 into appropriate data and command signals for forwarding to Internet access modem 210 or to tuners 204, demux chains 206 and mux 208. Such command signals can include information regarding which remote receiver has selected which program stream to receive.

Local set interface 216 includes MPEG-2 Transport demux 228 and MPEG/AC3 decoder 218, which can be both be implemented by, for example, chips from ST, Zoran, and LSI Logic. It also includes an IP stack 220, a graphics interface 222, a keyboard interface 224, and a remote control interface 226. Together, IP stack 220, graphics interface 222 and keyboard interface 224 preferably provide functionality akin to a web browser; alternatively, these functions can all be provided by a single-chip interactive TV device 230 such as the devices offered by TeleCruz.

IP stack 220 can be implemented internal to the single-chip device 230. Its purpose is to queue the IP packets (typically http, ftp or telnet type) between the Internet user operating the main TV 112 and external networks such as web servers, etc.

Graphics interface 222 can be can be implemented internal to the single-chip device 230. It

formats information and pages received from the Internet via IP stack 220 into TV output signals for displaying the information and pages.

Keyboard interface 224 can be can be implemented internal to the single-chip device 230. It translates keystrokes and mouse clicks generated by a user into IP packets for sending over the Internet via IP stack 220.

Remote control interface 226 can be can be implemented internal to the single-chip device 230. It translates channel selection and interactive TV commands generated by a user into control signals that can be used by tuners 204 and demux chains 206.

FIG. 3 further illustrates a slave set top box such as SSTB 116 in accordance with the principles of the invention.

As shown, SSTB 116 includes mobile radio transceiver 302, wireless protocol converter 304, Mpeg-2 Transport Demux 228, MPEG/AC3 decoder 308, IP stack 310, graphics interface 312, keyboard interface 314, and remote control interface 316. Although MPEG/AC3 decoder 308 is shown to be included in SSTB 116 in this example, alternatively, the functionality can be incorporated within TV set 114 (for example, an integrated TV receiver such as those from Sony, Panasonic, Thomson/RCA, or Samsung). Further, although not necessary for the present invention, the SSTB 116 also optionally includes a conditional access unit 306 for decrypting the signal just before reception by the TV receiver 114. The conditional access decoder is placed last in the signal chain to prevent access to the digital video stream by unauthorized users (e.g. pirates).

Mobile transceiver 302 is preferably a transceiver product developed in accordance with the HiperLAN and HiperLAN/2 broadband radio transmission standards. However, it should be apparent that other types of conventional transceivers are possible within the scope of this invention.

Wireless protocol converter 304 can be implemented by, for example, software running on a microprocessor such as those from MIPS and Intel. This block converts downlink signals containing program streams and Internet data from the appropriate protocol used for wireless transmission between base station transceiver 214 and the SSTBs 116. It also formats uplink signals such as data and command signals for forwarding to Internet access modem 210 or to tuners 204 and demux chains

206 into the appropriate wireless transmission protocol. Conditional access unit 306 can be implemented by, for example, a removable smart card or Point of Deployment module such as those built for the service providers by GI, Scientific-Atlanta, NDS, Nagra Interlocka, and GemPlus.

MPEG-2 transport demux 228 and MPEG/AC3 decoder 308 can be implemented by, for example, chips from ST, LSI Logic, or C-Cube.

Together, IP stack 310, graphics interface 312 and keyboard interface 314 preferably provide functionality akin to a web browser, and can be implemented within a single chip integrated TV device 320. IP stack 310 can be implemented within, for example, a single chip browser made for TV applications by Telecruz. Its purpose is to queue the IP packets (typically http, ftp or telnet type) between the Internet user operating the TV 114 and external networks such as web servers, etc.

Graphics interface 312 can be implemented as part of the TeleCruz chip 320. It formats information and pages received from the Internet via IP stack 310 into TV output signals for displaying the information and pages.

Keyboard interface 314 can be implemented as part of the TeleCruz chip 320. It translates keystrokes and mouse clicks generated by a user into IP packets for sending over the Internet via IP stack 310.

TVs 114 are controlled by handheld remote units, or remote keyboard units, in the normal fashion. The remotes are used as user interfaces for TV, interactive TV, and/or Internet access. Remote control interface 316 can also be implemented as part of the TeleCruz chip 320. It translates channel selection and interactive TV commands generated by a user into control signals that can be used by tuners 204 and demux chains 206.

Additional advantages that can be obtained by virtue of the present invention are illustrated by the alternative embodiment depicted in FIG. 4. In this embodiment of the invention, within MSTB 110' a Video Memory System (VMS) block 402 is placed between the conditional access encryption block of mux 208 and the Wireless Protocol converter 212. Preferably, the VMS 402 is implemented by a low-cost hard disk drive such as those adopted for consumer video by Seagate. Such a drive may be modified for low cost and consumer applications versus the type of drive built for computer

applications. The benefit of using a hard disk for this memory is that access is very fast and random.

The incorporation of the VMS block 402 provides TV viewers in the home with a "video pause" feature. With this feature, a user viewing a TV program signal can press a "pause" button on the remote control. At this time, the picture on the TV freezes on the last frame. The viewer can return to the TV at a later time, again press pause, and resume viewing the paused TV program without interruption. The pause feature is made possible by the presence of the VMS 402, which allows the TV material to be spooled up during and after the pause period. Many other features are possible using a VMS, such as filtering user preferred and/or user selected video material for later viewing. User selected material can include that specified directly by the user based upon a matrix of choices presented by an electronic program guide. User preferred material can be based upon tracking by the system of the channels and programs at specific times, thereby making possible the automatic profiling of the user's viewing habits; such systems are in use by TiVO and Replay TV and were first conceived and made public many years ago by Nicholas Negroponte, founder of MIT's Media Labs and published in his book Being Digital, Jan 95.

This embodiment of the invention expands the conventional concepts of VMS since now other users can share the VMS wirelessly. Thus an entire network of users can be enjoying material from the VMS, or from real time, or both (with picture in picture or multi picture arrays).

Each STB in the home wireless network, including the MSTB 110 and the SSTBs 116, supports remote control commands that control the VMS and its functions such as video pause. Such commands are captured by the remote control interfaces of such STBs and converted into control signals that are then provided to VMS 402. Preferably, the VMS is configured to allow reading and writing of several video streams simultaneously. This should not be a problem where a single picture video data rate is typically below 19.4 Mb/s; accordingly, for 5 users, the maximum throughput rate (R+W) would be less than 200 Mb/s or 25 MB/s, which is well within the capabilities of modern hard disc drives.

The storage system of the present invention is particularly economical since the signals incoming to the system are already digitally encoded (i.e. MPEG2) by the satellite operators, and thus

no expensive encoding chips are needed before storage. Moreover, VMS 402 can be used as a buffer for Internet pages, i.e. as a proxy store. This allows recently viewed web (e.g. HTML) pages and their associated resources (e.g. .jpg, .gif or other ancillary files) to be stored locally until they are changed at the serving point, thereby improving performance for the user while decreasing traffic from the ISP to the user.

An alternative embodiment of the present invention is illustrated in FIG. 5. In this embodiment of the invention, MSTB 110'' additionally includes a wired Internet access unit 502 that is connected with an Internet source 504. The Internet source 504 may include a telephone port, an XDSL line, a cable modem, or even a wireless source such as a local loop, a multi-channel multi-point distribution service (MMDS) or a Local Multi-point Distribution Service (LMDS). In this embodiment, alternative Internet sources are included in the system in a seamless way that does not require the user to differentiate between the sources of the content received.

The present invention can be configured to further limit the amount of hardware inside the home. In the alternative embodiment illustrated in FIG. 6, the basic functionality of the MSTB 110 is included in an external House Side Box (HSB) 702 so that all signals to the home 104 are made via the antennas 124.

A preferred embodiment of the HSB 702 of FIG. 6 is illustrated in FIG. 7. The essential design difference between the HSB 702 illustrated in FIG. 7 and the MSTB 110'' illustrated in FIG. 5 is the elimination of the link from the MUX 208 to the main TV 112 since all transmissions are made wirelessly to SSTBs 116. Likewise the alternative embodiments of MSTBs 110—110' are likewise adaptable to the design of the HSB 702 by elimination of the interface to the main TV 112 (or the corresponding local set interface 216 in FIG. 2). A corresponding design for the SSTB 116 of FIG. 6 is illustrated in FIG. 8 where the transceiver 302 of the SSTB 116 communicates with the HSB 702.

The embodiment illustrated in FIG. 6 advantageously eliminates all cabling between the outdoor satellite antennas (102, 122) and the interior of the home 104. In addition, no cabling is needed inside the home 104. Thus, the installation process is substantially easier from the user's perspective since there are no cables to attach inside the home 104. Furthermore, it is easier to

relocate the TVs 114 inside the home since none are tethered by cabling.

An alternative approach to the elimination of all cabling in the house is also possible. FIG. 9A illustrates the embodiment of the present invention shown in FIG. 6 where the antennas 124 provide wireless links (118, 120) from the HSB 702 to the SSTBs 116. In FIG 9B an alternative embodiment is illustrated where the antennas 124 associated with the HSB 702 in FIG. 6 are replaced by an antenna relay system 802 that is connected to the HSB 702 by a relay cable 804. According to the embodiment of FIG. 9B, minimal cabling is introduced into the home with the benefit of reducing the distances of the corresponding wireless links between the antenna relay system 802 and the SSTBs 116. Such an arrangement avoids penetrating an outside wall of the home 104 with a wireless link.

Although the present invention has been described in detail with reference to the preferred embodiments thereof, those skilled in the art will appreciate that various substitutions and modifications can be made to the examples described herein while remaining within the spirit and scope of the invention as defined in the appended claims.

What is claimed is:

1. A device for distributing video signals, comprising:

an input for receiving a wideband video signal;

a plurality of tuners for selectively down-converting the wideband video signal to corresponding baseband video signals, the selection being based on control signals originating from remote receivers, the corresponding baseband video signals being respectively associated with the remote receivers;

a plurality of demux chains for respectively converting the baseband video signals into corresponding transport streams;

a multiplexer that aggregates the transport streams into a broadcast stream; and

a base station transmitter that transmits the broadcast stream for wireless reception by the remote receivers.

2. A device according to claim 1, wherein the wideband signal originates from two or more sources, the device further comprising an RF switch for selectively inputting the wideband signal from the two or more sources in accordance with the control signals originating from the remote receivers.

3. A device according to claim 2, wherein the two or more sources are satellite television receivers.

4. A device according to claim 1, further comprising an Internet access modem for communicating data signals with the Internet, the Internet access modem converting between data signals communicated with the Internet and data streams communicated with the multiplexer, the multiplexer further aggregating the data streams into the broadcast stream.

5. A device according to claim 4, wherein the Internet access modem is coupled to an Internet satellite transceiver.

6. A device according to claim 1, further comprising an wired Internet access unit for communicating data signals with the Internet, the Internet access unit converting between data signals communicated with the Internet and data streams communicated with the multiplexer, the multiplexer further aggregating the data streams into the broadcast stream.

7. A device according to claim 1, further comprising a conditional access device capable of preventing unauthorized broadcast of one or more of the baseband signals to the remote receivers.

8. A device according to claim 1, further comprising a local TV set interface for receiving the broadcast stream from the multiplexer and converting the broadcast stream into video signals that can be displayed on a local TV set being one of the remote receivers, the local TV set interface further capable of providing certain of the control signals.

9. A device according to claim 1, further comprising video memory storage for storing selected portions of the broadcast stream.

10. A device according to claim 9, wherein the video memory storage is further capable of selectively playing back the stored selected portions.

11. A device for distributing video signals, comprising:

means for receiving a wideband video signal;

means for selectively down-converting the wideband video signal to corresponding baseband video signals, the selection being based on control signals originating from remote receivers, the corresponding baseband video signals being respectively associated with the remote receivers;

means for respectively converting the baseband video signals into corresponding transport streams;

aggregating means for aggregating the transport streams into a broadcast stream; and

means for transmitting the broadcast stream for wireless reception by the remote receivers.

12. A device according to claim 11, wherein the wideband signal originates from two or more sources, the device further comprising means for selectively inputting the wideband signal from the two or more sources in accordance with the control signals originating from the remote receivers.

13. A device according to claim 12, wherein the two or more sources are satellite television receivers.

14. A device according to claim 11, further comprising means for communicating data signals with the Internet, the communicating means converting between data signals communicated with the Internet and data streams communicated with the aggregating means, the aggregating means further aggregating the data streams into the broadcast stream.

15. A device according to claim 14, wherein the communicating means is coupled to an Internet satellite transceiver.

16. A device according to claim 11, further comprising conditional access means for preventing unauthorized broadcast of one or more of the baseband signals to the remote receivers.

17. A device according to claim 11, further comprising interface means for receiving the broadcast stream from the aggregating means and converting the broadcast stream into video signals that can be displayed on a local TV set being one of the remote receivers, the interface means further providing certain of the control signals.

18. A device according to claim 11, further comprising means for storing selected portions of the broadcast stream.

19. A device according to claim 18, further comprising means for selectively playing back the stored selected portions.

20. A method for distributing video signals, comprising:

receiving a wideband video signal;

selectively down-converting the wideband video signal to corresponding baseband video signals, the selection being based on control signals originating from remote receivers, the corresponding baseband video signals being respectively associated with the remote receivers;

respectively converting the baseband video signals into corresponding transport streams;

aggregating the transport streams into a broadcast stream; and

transmitting the broadcast stream for wireless reception by the remote receivers.

21. A method according to claim 20, wherein the wideband signal originates from two or more sources, the method further comprising selectively inputting the wideband signal from the two or more sources in accordance with the control signals originating from the remote receivers.

22. A method according to claim 21, wherein the two or more sources are satellite television receivers.

23. A method according to claim 20, further comprising communicating data signals with the Internet, the communicating step comprising converting between data signals communicated with the Internet and data streams communicated with the aggregating means, the aggregating step further comprising aggregating the data streams into the broadcast stream.

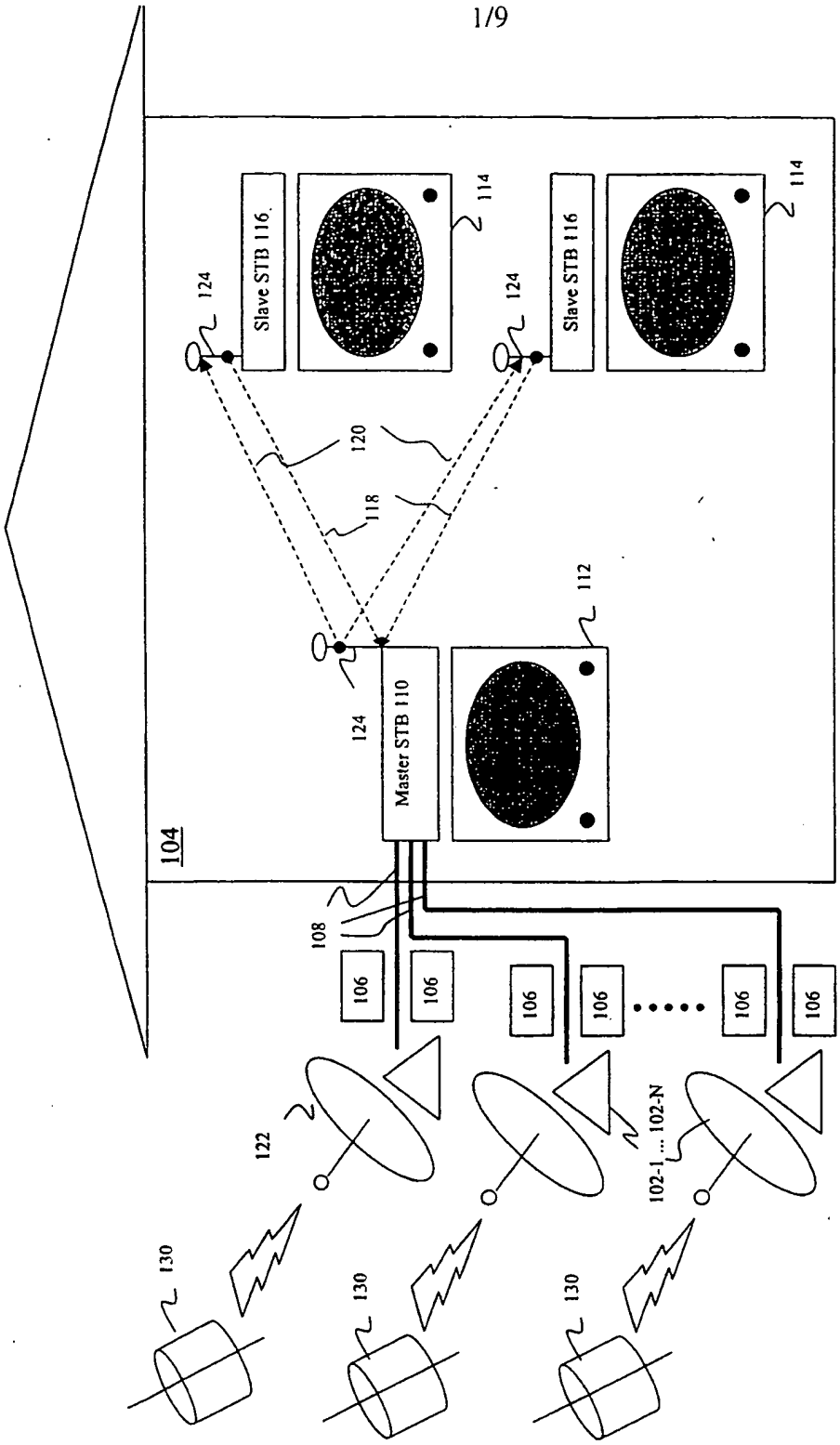
24. A method according to claim 23, wherein the communicating step further comprises communicating the data signals with an Internet satellite transceiver.

25. A method according to claim 20, further comprising preventing unauthorized broadcast of one or more of the baseband signals to the remote receivers.

26. A method according to claim 20, further comprising locally converting the broadcast stream into video signals that can be displayed on a local TV set being one of the remote receivers, and locally providing certain of the control signals.

27. A method according to claim 20, further comprising storing selected portions of the broadcast stream.

28. A method according to claim 27, further comprising selectively playing back the stored selected portions.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Slave STB 116
Master STB 110
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112
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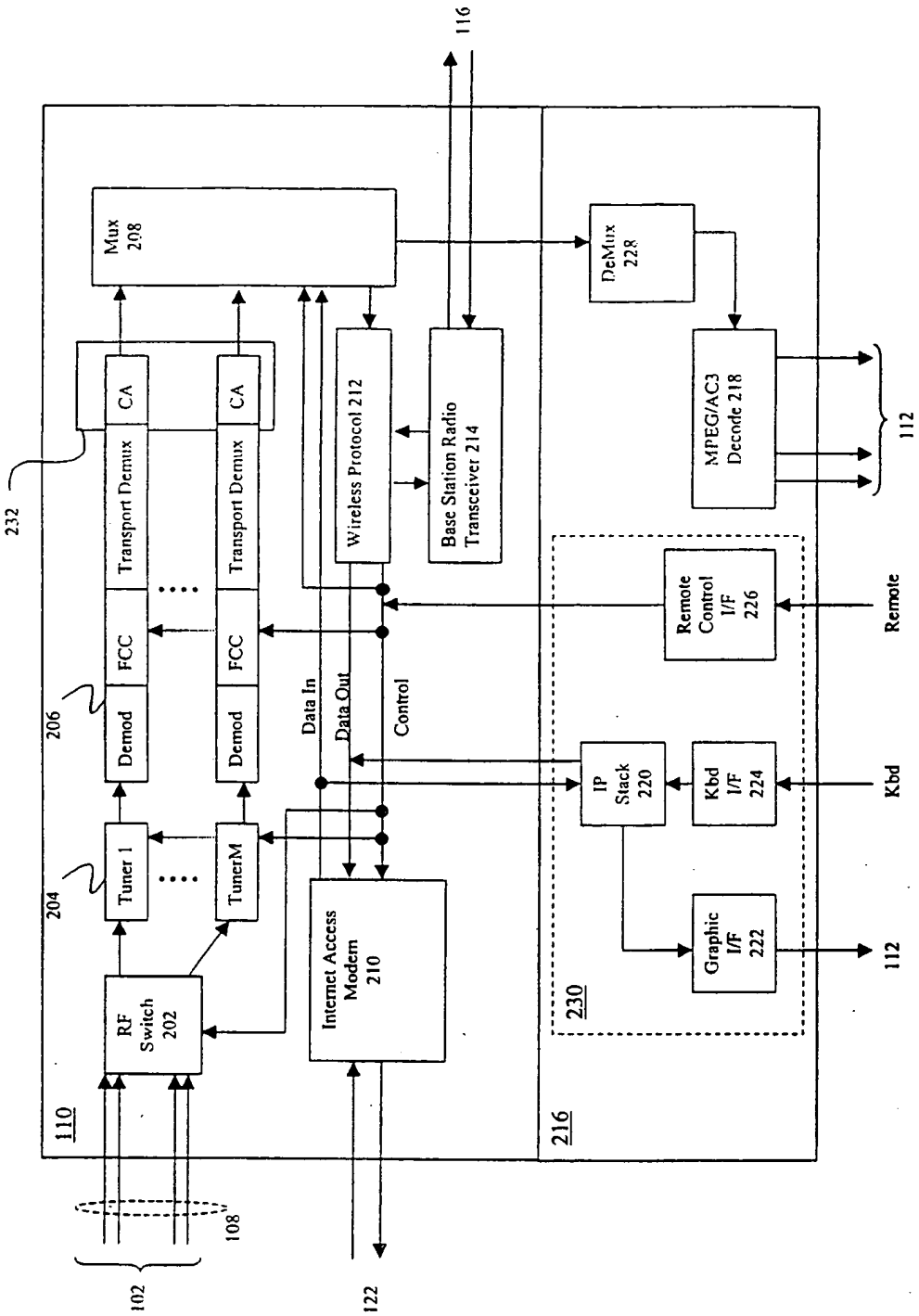
106
106
106
122
102-1 ... 102-N
130
130
130

FIG. 1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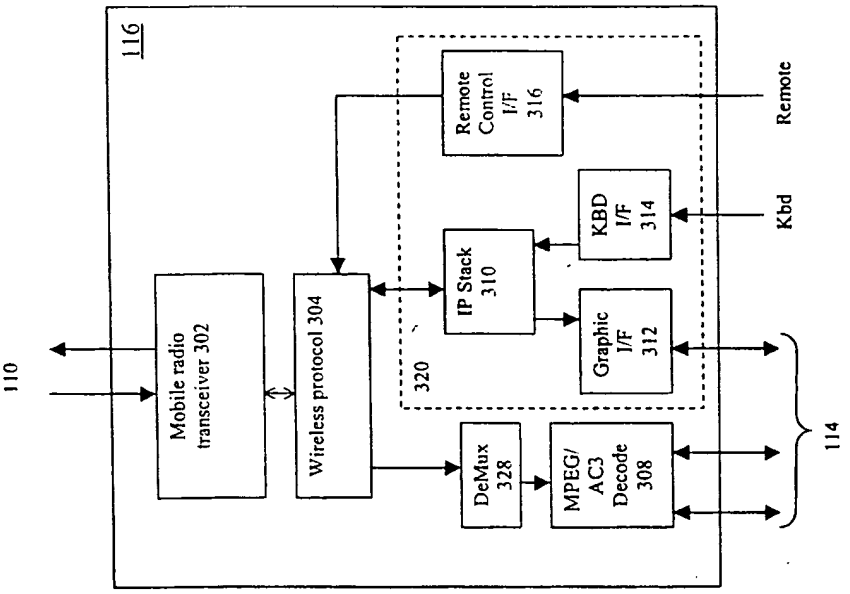
DeMux 228
MPEG/AC3 Decode 218
112
232
CA
Transport Demux
FCC
Demod
206
Wireless Protocol 212
Base Station Radio Transceiver 214
Remote Control I/F 226
Remote
Data In
Data Out
Control
IP Stack 220
Kbd I/F 224
Kbd
Tuner 1
TunerM
204
Internet Access Modem 210
Graphic I/F 222
230
RF Switch 202
110
216
108
102
122

FIG. 2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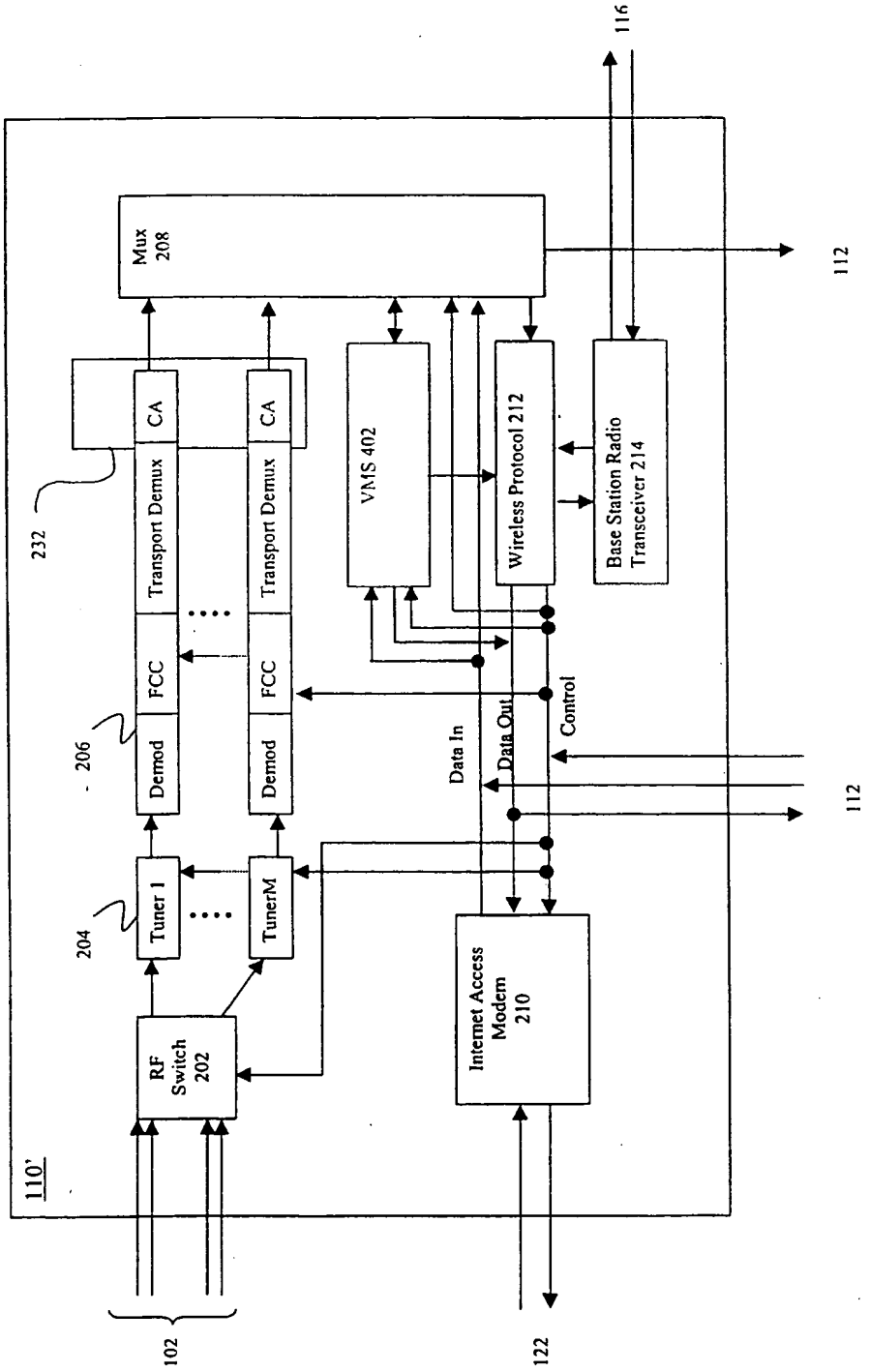
Remote
KBD I/F 314
Kbd
IP Stack 310
Graphic I/F 312
320
110
Mobile radio transceiver 302
Wireless protocol 304
DeMux 328
MPEG/ AC3 Decode 308
114

FIG. 3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232
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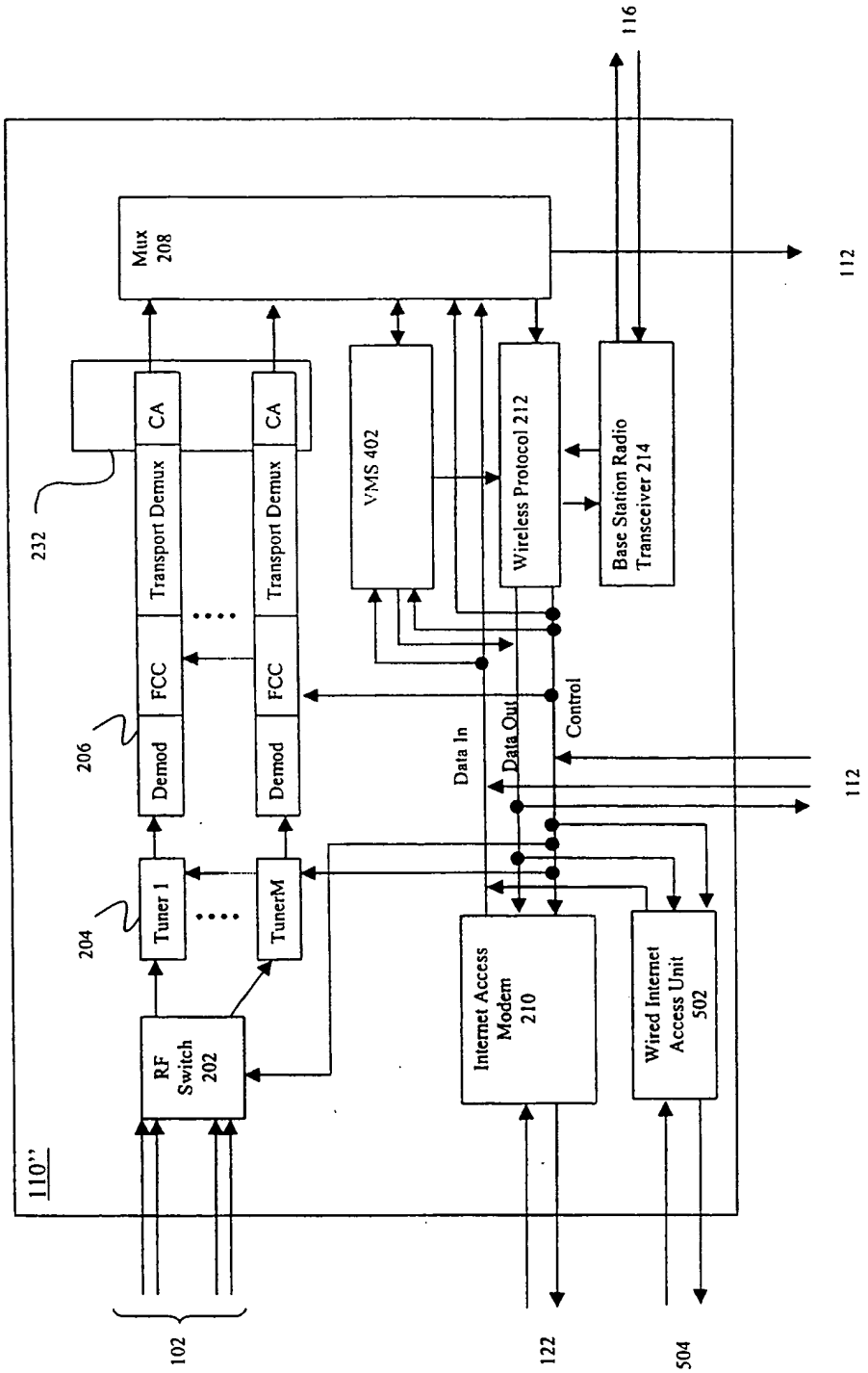
Transport Demux
VMS 402
Wireless Protocol 212
Base Station Radio Transceiver 214
FCC
FCC
206
Demod
Demod
Data In
Data Out
Control
112
Tuner 1
TunerM
204
RF Switch 202
Internet Access Modem 210
110'
102
122

FIG. 4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CA
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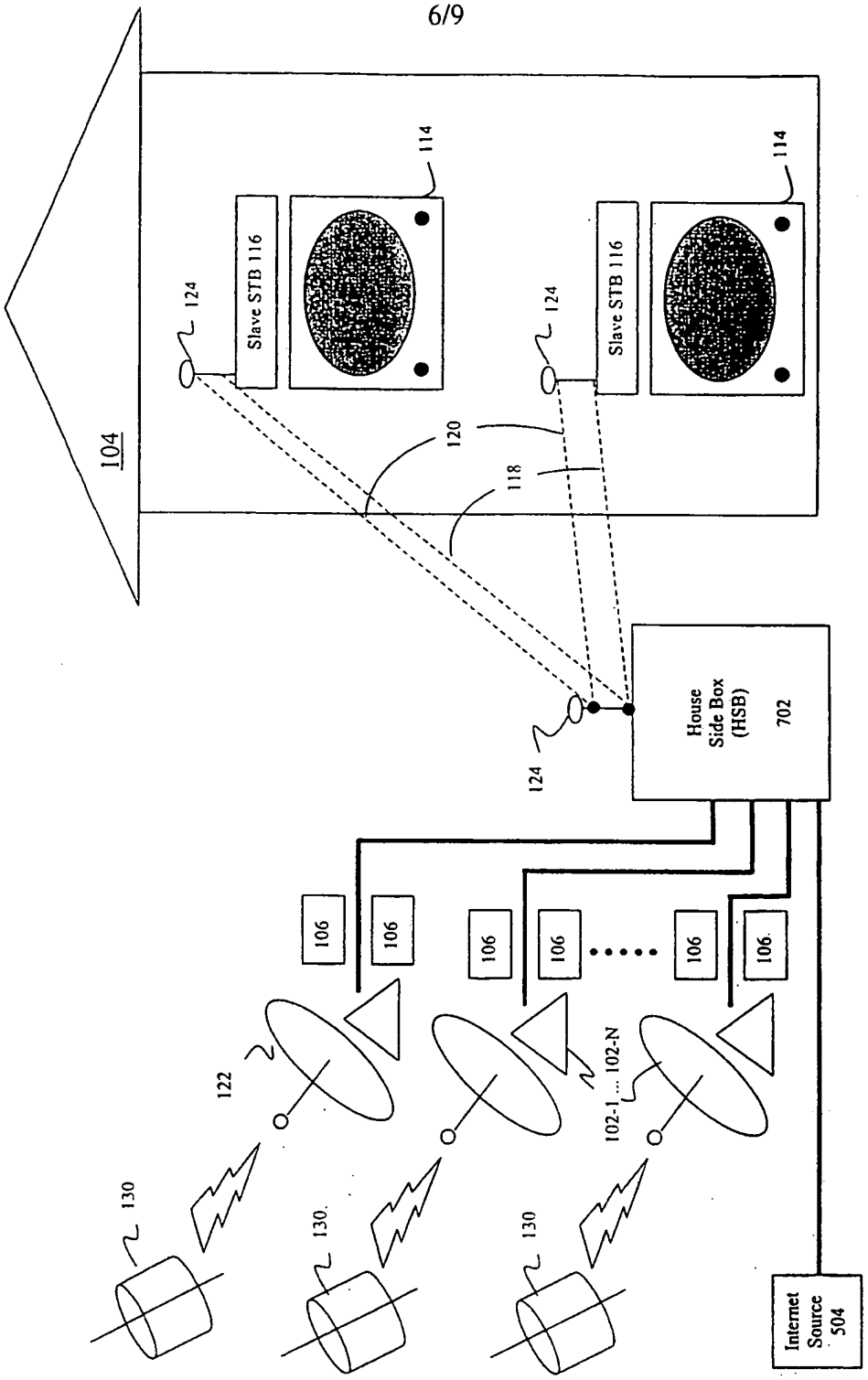
Transport Demux
232
FCC
FCC
Demod
Demod
206
VMS 402
Wireless Protocol 212
Base Station Radio Transceiver 214
Data In
Data Out
Control
112
Tuner 1
TunerM
204
RF Switch 202
Internet Access Modem 210
Wired Internet Access Unit 502
110''
102
122
504

FIG. 5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114
124
120
118
House Side Box (HSB) 702
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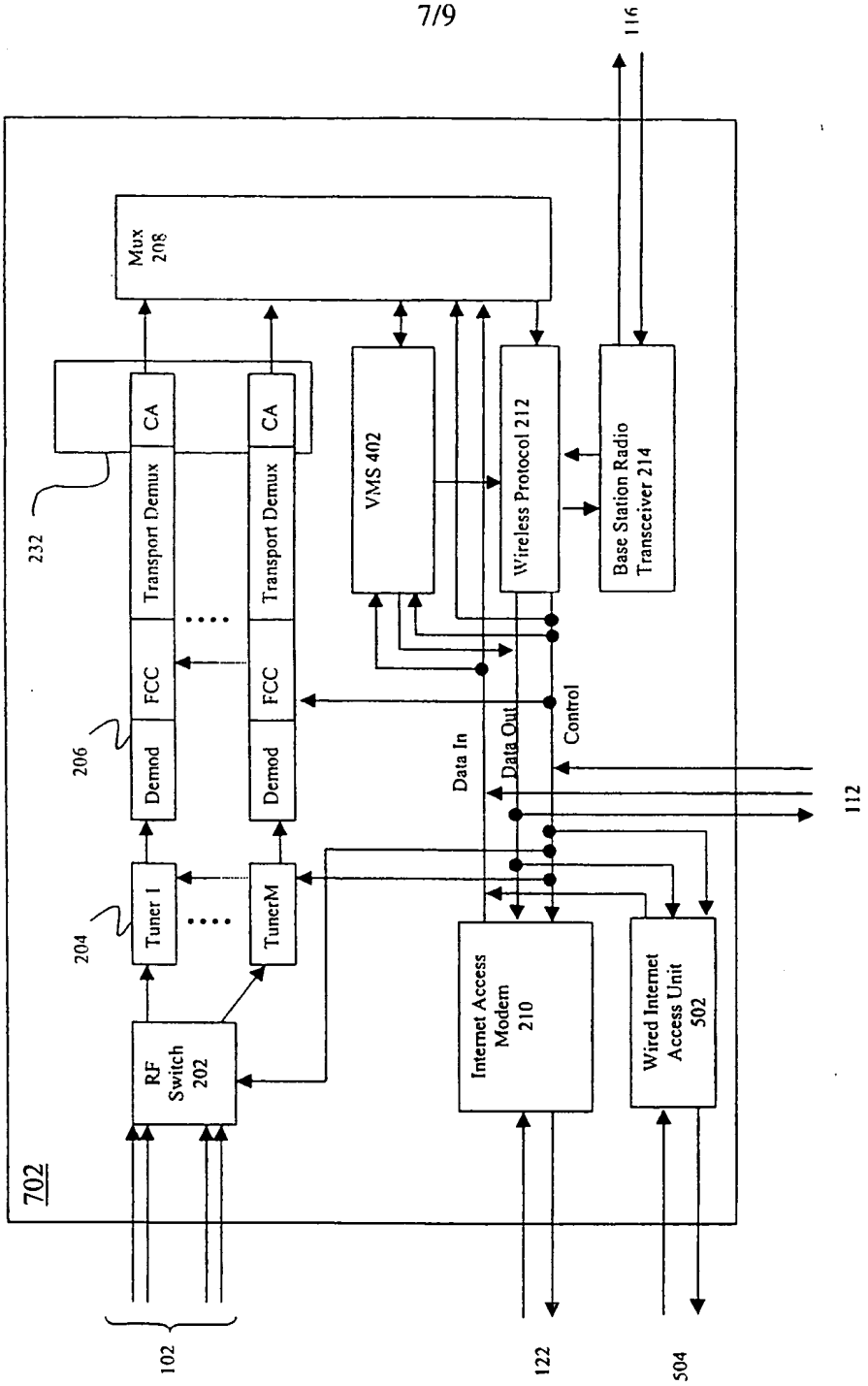
122
102-1 ... 102-N
130
Internet Source 504

FIG. 6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Mux 208
CA
CA
Transport Demux
Transport Demux
232
VMS 402
Wireless Protocol 212
Base Station Radio Transceiver 214
FCC
FCC
Demod
Demod
206
Data In
Data Out
Control
112
Tuner 1
TunerM
204
RF Switch 202
Internet Access Modem 210
Wired Internet Access Unit 502
702
102
122
504

FIG. 7

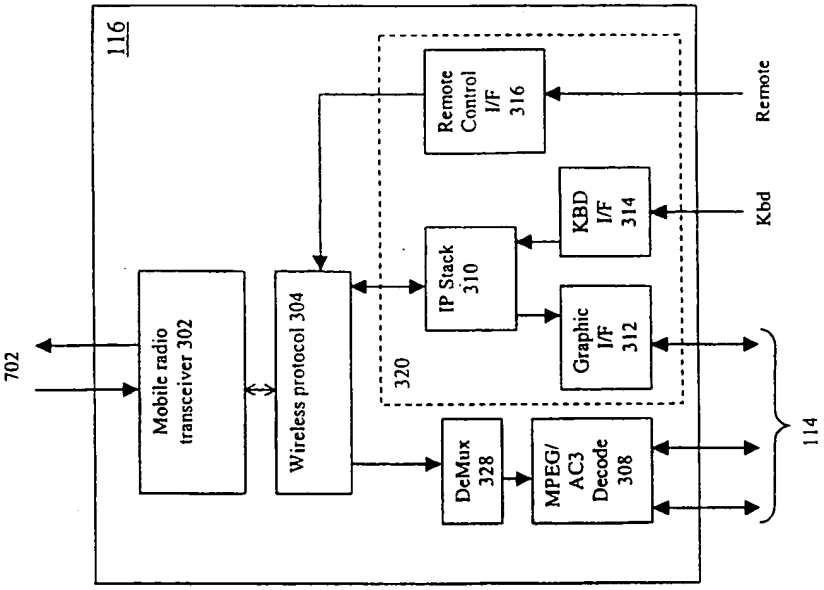
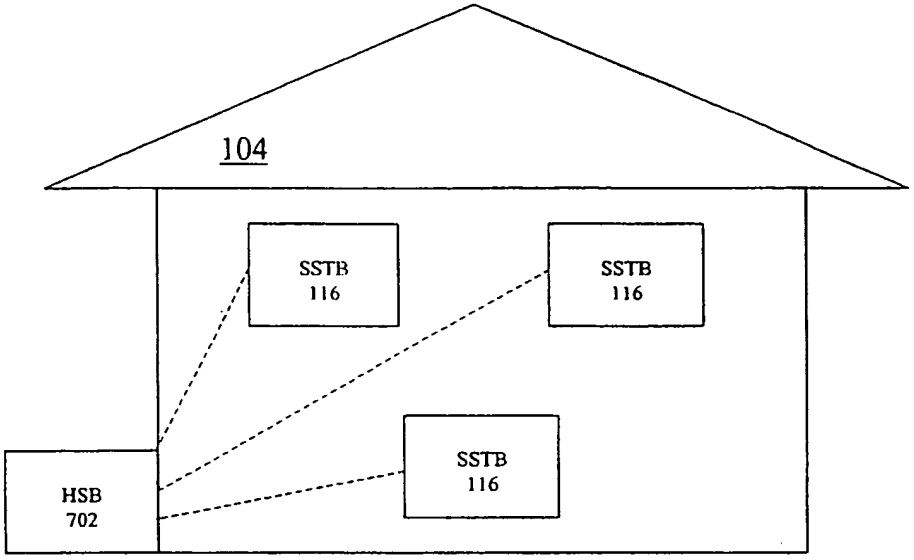

116
Remote Control I/F 316
Remote
KBD I/F 314
Kbd
IP Stack 310
Graphic I/F 312
320
702
Mobile radio transceiver 302
Wireless protocol 304
DeMux 328
MPEG/ AC3 Decode 308
114

FIG. 8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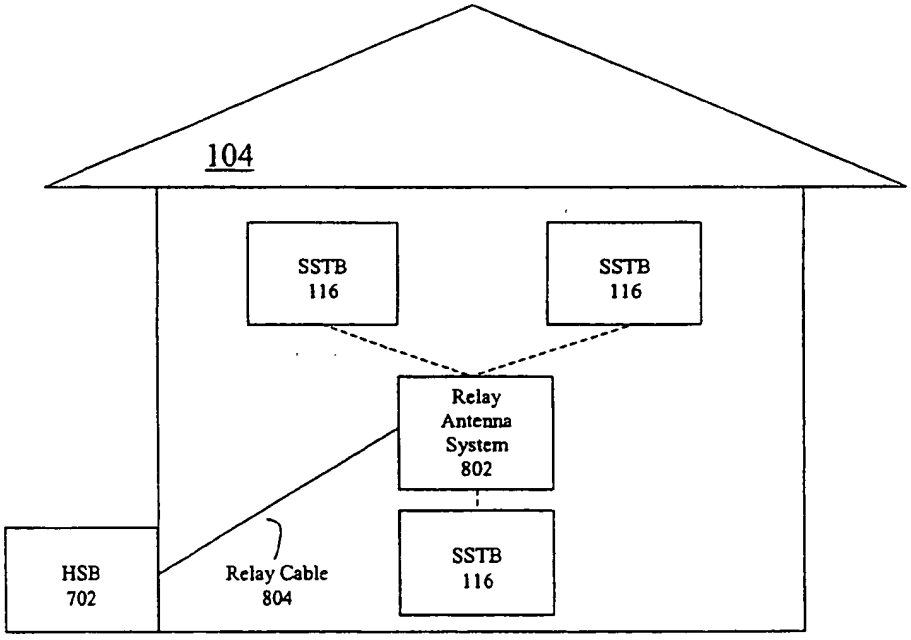
SSTB
116
HSB
702

FIG. 9A


104
SSTB
116
SSTB
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Relay
Antenna
System
802
SSTB
116
HSB
702
Relay Cable
804

FIG. 9B

INTERNATIONAL SEARCH REPORT

Inter 'onal Application No
PCT/US 01/02628

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04N7/24 H04N5/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04N H04J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 917 355 A (SONY INT EUROP GMBH) 19 May 1999 (1999-05-19) paragraph '0015! paragraph '0019! - paragraph '0025! paragraph '0034! - paragraph '0036! ---	1-3,8, 11-13, 17, 20-23,26
X	EP 0 785 675 A (TOKYO SHIBAURA ELECTRIC CO) 23 July 1997 (1997-07-23) page 5, column 8, line 23 -page 7, column 12, line 15 --- -/--	1-3, 9-13, 18-22, 27,28

[X] Further documents are listed in the continuation of box C. [X] Patent family members are listed in annex.

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26 April 2001	07/05/2001

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Marie-Julie, J-M

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Form PCT/ISA/210 (second sheet) (July 1992)

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 969 665 A (CIT ALCATEL) 5 January 2000 (2000-01-05) paragraph '0007! - paragraph '0008! ---	1-6,8, 11-17, 20-24,26
A	WO 97 19554 A (SAMSUNG INFORMATION SYSTEMS AM) 29 May 1997 (1997-05-29) page 5, line 8 -page 6, line 13 page 9, line 17 - line 22 page 13, line 29 -page 14, line 24 ---	1-6,8, 11,15, 17, 20-24,26
A	OLSHANSKY R ET AL: "RESIDENTIAL LAN ARCHITECTURE" PROCEEDINGS OF THE INTERNATIONAL WORKSHOP ON COMMUNITY NETWORKING, 20 June 1995 (1995-06-20), XP000645914 the whole document ---	1,4,5, 11,14, 15,24
A	US 5 574 964 A (HAMLIN CHRISTOPHER L) 12 November 1996 (1996-11-12) column 2, line 8 - line 25 column 2, line 54 -column 5, line 7 -----	1,11,24

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INTERNATIONAL SEARCH REPORT

.ormation on patent family members

Inter ›nal Application No
PCT/US 01/02628

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0917355 A	19-05-1999	CN 1219809 A	16-06-1999
		JP 11239186 A	31-08-1999
EP 0785675 A	23-07-1997	JP 9200691 A	31-07-1997
		CA 2195161 A	17-07-1997
EP 0969665 A	05-01-2000	AU 3577099 A	06-01-2000
		JP 2000151717 A	30-05-2000
WO 9719554 A	29-05-1997	CA 2238325 A	29-05-1997
		CN 1207851 A	10-02-1999
		EP 0862832 A	09-09-1998
		JP 2000513514 T	10-10-2000
US 5574964 A	12-11-1996	NONE	